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ABSTRACT

This article, which provides answers to commonly asked questions about teaching science in the primary grades, is part of a series included in the Primary Packet of Materials compiled by the Division of Early Childhood Education of the Pennsylvania Department of Public Instruction. Questions considered are: What is science? What should students be taught in science? Which textbook is best, or is a multi-text approach best? How does one find time to teach science? How are student differences provided for? Are there national programs for science as there are for mathematics? The article also includes a list of desirable characteristics for a school science program and a 2-page bibliography. (JF)

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Science For
The Primary Grades
Questions And Answers

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This article, written by DR. IRVIN T. EDGAR, Science Adviser, is part of a series included in the Primary Packet of Materials. The packet is compiled by the Division of Early Childhood Education, Mrs. Charlotte G. Garman, Coordinator.

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To the Primary Teacher -

Science frightens many elementary teachers. It can frighten anyone - or at least anyone who feels they need to know all the answers to questions about science. It is not the sort of subject one learns about the night before, basically because science is applying what you understand to new events so that you can predict, control, or explain in advance what will happen when you do certain things with your surroundings. Primary teachers need not be too terribly concerned about knowing the answers in science since the most important things they can do are to instill in their students an attitude of curiosity and the habit of careful observation. Not only is it unnecessary to know the answers to accomplish this, it may in fact prove to be a disadvantage if the teacher <u>does</u> know the answers since in this case the temptation to merely tell the answers is strongest.

Teaching science is most successful if the experiences of the teacher and students are characterized by open-minded observation, discussion, and a willingness to interpret the events before the class. This kind of experience is the opposite of telling students pre-digested seemingly unalterable facts which sometimes do, but more often do not confirm student observations. Science must be new and exciting to both the student and the teacher. For this reason, instead of merely confirming

science principles, it is better to discover them with your students. If your science activity does not seem to agree with the laws of science as you know them, it is probably because of influences that you may not have planned for in your activity. The laws of nature (which incidentally are made by man) have not been changed by your experience. But perhaps your lesson has. It may have truly become an experiment. Furthermore if circumstances such as these leave you and your students a little bewildered by the many possible answers to what has happened, cheer up. This is a sign that you have just entered the world of science.

Certai questions about teaching science in the primary grades are asked time and again. These questions illustrate the common concerns of primary teachers. The following sections are devoted to answering these questions as briefly as possible. Also, an attempt is made to provide some practical suggestions for teaching science in the primary grades, whenever it seemed sensible to do so.

What Is Science?

There have been many definitions written for the word science, and certainly the idea that "science" includes a body of knowledge is important. But for the teacher of science, it is best to think of science as a carefully planned way of asking and answering questions. Some answers are obtained through experimentation, others through observation and reading. In every case, the correct answer is almost inescapable in a logical plan of investigation.

What Should I Teach My Students In Science?

Perhaps it is better to ask "What should my students learn about science?" The target of your efforts must be the student and not the selection of science topics.

There is no single answer to this question, but there are some points that should be remembered.

(1) It is better to study fewer things in science, and to explore them in greater depth. The main ideas of science (underlying concepts) are described in most books concerned with teaching elementary science and can be taught using any number of different science topics.

(2) Help students to recognize that scientific truths are really tentative in nature and limited by the skills and techniques of the scientist. The students can be scientists in the same way as they draw conclusions from their experiences, following careful observation.

(3) Insist that the students find their answers in the physical environment of their activities or experiments. Discourage them from forming the habit of expecting the teacher to have (and provide) all the answers.

(4) Help students to think critically about problems. Aid them in learning the habit of thinking a while before deciding on matters, and guide them to learn to be willing to change their opinions when evidence shows them wrong.

(5) Above all, give students every opportunity to relate science to their daily lives; in the things they see and read about, hear and talk about, and choose to do.

It is unrealistic to expect that all students will show total success in learning to behave scientifically. The most that can be

expected of any teacher is that he will help each student to learn to behave as scientifically as possible within his own circumstances.

What Textbook Is Best or Should Science Be Taught From A Multi-text Approach?

Textbooks are tools to learning. They should not become the science curriculum. Instead, the textbook should assist you and your students in learning about science. Since schools will differ in the nature of their science program, the choice of textbooks is a decision for the local schools to make. Generally, the textbook(s) which seem to suit your program and objectives best would be the most useful. Using more than one textbook requires more teacher time in planning, but it also provides a variety of information for students to use in studying science.

In any case, science instruction should, as much as possible, be centered around the interests, abilities, and activities of the students. No curriculum, however sophisticated, can succeed otherwise.

How Do I Find The Time To Teach Science?

This is the most difficult obstacle for the elementary teacher to overcome. No one can quarrel with the importance of teaching elementary students the skills of communication. Furthermore, the results of student reading instruction are readily measured so that virtually every child is categorized according to reading level. The implications of this for teacher instructional time are obvious.

Studies have underlined the need for students to learn about science in the elementary school since some will not proceed to secondary school, or if they do, few of them will elect the study of science subjects. But the question of how to find time to learn science does

not necessarily have to be answered by sacrificing the study of other subjects in the elementary school. Rather, much science study can be achieved as part of other elementary subjects, or during that time not accounted for by the children's schedule. The following five examples serve as illustrations:

1. Include stories about science in reading, experience stories, and language activities. Try to stress habits of thinking scientifically, and relate science to daily life. Stories with unsolved endings may be used to stimulate class activities that will be done at a later time. Stories, read or told, illustrating the limited but logical conclusions of scientists in the past, help to stress the notion that science is not always infallible and that "all the facts" are not in, even today.

   Much of the critical thinking needed to be scientific can be taught through reading activities and especially those that emphasize how communication describes the real world around the student..

2. Choose science activities for the information used in writing activities. Show students the necessity of describing accurately what they have observed, and prevent them from straying into the habit of drawing conclusions that cannot be supported from their limited experiences. (Words such as "all," "always," and "never" may need to be replaced with "many," the object's "name," "in our experiment," "sometimes," etc.)

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3. Describe experiments or experiences quantitatively wherever possible. Counting activities, measuring activities, and simple computations provide the logical bridge for students to understand how science and mathematics are inseparable. Measuring and comparing different sizes, for example, can be accomplished simply by cutting colored paper strips to the actual size of the objects. Pasting the strips on paper can be used to show elementary graphing relationships and the need for orderly presentation of information. Rulers, yardsticks, meter sticks, eyedroppers, glasses, scales, and many other devices can be employed to show relative quantitative differences. For better students, actual measuring units, English and metric, can be used.
4. Provide a place for long term science activities that may be left undisturbed and returned to by students, during free time, for further exploration. Science locations can offer motivation to students, and may serve as alternates to seat work, before-school, after-school, and free time activities. Materials that can be manipulated should be used as often as possible so that these locations do not become displays of the cut, picked, and pickled things of science.
5. Practice and become familiar with numerous science activities. Science, by its very nature, can provide a flexible schedule since certain days may require only a few minutes for students to observe an experiment and record their findings. Other days may require longer periods for discussion of

results, set-up of simple apparatus, or class consideration of results from separate student groups.

Without question, it is difficult to squeeze out any additional time from the elementary program to use for teaching science. However, it is impossible to justify not preparing students to live in a society unquestionably dominated by science. An enterprising teacher will be capable of relating science with many other experiences to gain additional free time to use for student activities with the things of science.

How Do I Provide For Student Differences In Science?

Providing for student differences in learning science is no different from providing for student differences in learning any subject. Ideally, students should be learning different amounts of science according to individual rates. Except for individually prescribed programs in science, this is not likely to be the case in your school.

Two possibilities are: (1) students of differing abilities will have to take away different amounts of understanding from exposure to the same science activity, or (2) separate experiences will have to be provided according to differences in student abilities. Alert students can be led to explore the depths of an activity while other students may develop only a minor grasp of the many implications of the activity. Naturally, individualized activities are possible only when students work with materials singly or in small groups; further exploration by alert students is possible using this same procedure. In addition, handling of concrete items can produce greater understanding among culturally disadvantaged students at the same time it provides them with visual and tactile experiences. The disadvantaged child finds greater

satisfaction in using his hands than in the relatively unfamiliar, over-used practice of abstract thinking.

Every attempt should be made therefore to construct science experiences that draw upon, or use mainly, individual activities with the materials of science. When the teacher is sophisticated in the ways of teaching science, the students may be allowed to move in many directions at the same time with their activities. With the less confident teacher, the students may consider the same experience simultaneously, extracting understanding according to their own abilities. In any case, it is more important to worry about whether the students are doing science and actively experimenting with things than to worry about which method of teaching should be used.

Are There National Programs For Science Similar To Those For Mathematics?

There have been a number of science programs developed for the elementary school (see bibliography for listing). Essentially they embody many of the suggestions already given in this publication, and of course, a great many more. The elementary teacher should read about the new programs as part of keeping generally informed. If you or your school district are seriously considering the adoption of one of these programs, it is important to remember that most teachers will need practice in the philosophy and activities of the program. College courses, institutes, or well-planned inservice activities are recommended for the uninitiated teacher. In addition, on-site consultative assistance throughout the school year is desirable.

A teacher can draw upon the newer programs for science activities and representative guidance in the teaching of science. It is not

necessary, however, to be part of a modern "alphabet" program in order to teach science well and provide an excellent elementary science program.

Final Notes

It is doubtful that merely reading this publication will make an elementary teacher better at teaching science. Much more individual effort is required. If a teacher begins trying to implement the suggestions presented here and reads further about elementary science, then a true measure of success will have been achieved. No device has yet been created that can recognize what students are or are not able to learn according to their level of maturity (at a moment's notice), or can adapt the learning activity to suit the capability of the student. Only a qualified teacher can do this.

Characteristics of a Desirable School Science Program

1. The objectives for the science program are carefully stated and kept up-to-date. The objectives concern significant ideas and are endorsed by teachers, administrators, and parents.
2. The science program is suited to children's interests and requirements. The program challenges the more able student while providing for average and less able students.
3. The science program is planned to provide sequential activities. Each year builds on the previous year of learning with needless repetition carefully avoided. Current events of scientific interest are provided for in the science program as supplementary to a total, flexible plan.

4. Adequate instructional materials are provided to support the science program, including science apparatus, textbooks, audiovisual materials, and science books.
5. The principal understands the nature of science teaching and supports a desirable science program.
6. Science is an appropriate part of the elementary school program and contributes to other subjects, adding to the complementary nature of all subjects in the elementary curriculum.
7. Parents are interested in science as well as the community in general.
8. Frequent opportunities are provided for teachers to learn on the job through inservice science education workshops, special lectures and courses, and consultant help.
9. Students show enthusiasm for science during and after school.

BIBLIOGRAPHY

Berck, Irene E. Simple Science Experiments for the Elementary Grades, Franklin Publishing Company, New Jersey, 1960.

Blough, Glenn O. It's Time for Better Elementary School Science, National Science Teachers Association, Washington, D. C., 1958.

Blough, Glenn O. You and Your Child and Science, National Science Teachers Association, Washington, D. C., 1963.

Burnett, Will R. Teaching Science in the Elementary School, Holt, Rinehart and Winston, New York, 1960.

Carin, Arthur and Sund, Robert B. Teaching Science Through Discovery, Charles E. Merrill Books, Inc., Columbus, Ohio, 1964.

Come, Thomas V. Investigations in Science Elementary Science Workshops Edinboro State College, Edinboro, Pennsylvania, 1965.

Craig, Gerald S. Science for the Elementary School Teacher, Ginn and Company, New York, 1966.

Gega, Peter C. Science in Elementary Education, Wiley and Sons, Inc., New York, 1966.

Hopman, Anne B. Compiler. Helping Children Learn Science, National Science Teachers Association, Washington, D. C., 1966.

"How-to-Do-It" Series, National Science Teachers Association, Washington, D.C.

- How to Utilize the Services of a Science Consultant, (1965)
- How to Care for Living Things in the Classroom, (1965)
- How to Teach Science through Field Studies, (1965)
- How to Record and Use Data in Elementary School Science, (1965)
- How to Individualize Science Instruction in the Elementary School, (1965)
- How to Evaluate Science Learning in the Elementary School, (1968)
- How to Use Photography as a Science Teaching Aid, (1968)

Investigating Science With Children, National Science Teachers Association Teachers Publishing Corp., Darien, Connecticut.

- Vol. 1, Living Things
- Vol. 2, The Earth
- Vol. 3, Atoms and Molecules
- Vol. 4, Motion
- Vol. 5, Energy in Waves
- Vol. 6, Space

Science in Action, DPI, Harrisburg, Pennsylvania, Dr. Irvin T. Edgar, Box 911

Tannenbaum, Harold E. and Stillman, Nathan. Science Education for Elementary School Teachers, New York, Allyn and Bacon, 1965.

Vessel, M. F. Elementary School Science Teaching, The Center for Applied Research in Education, Inc., Washington, D. C., 1963.

Victor, Edward. Science For the Elementary School, MacMillan Co., New York, 1965.

Wensberg, Katherine. Experiences With Living Things; An Introduction to Ecology for Five to Eight Year Olds, Beacon Press, Boston, 1966.

New Science Curricula

AAAS Commission on Science Education, Science--A Process Approach, Xerox Corporation - Ginn and Company.

Science Curriculum Improvement Study (SCIS) Robert Karplus, University of California, Berkeley, and D. C. Heath and Company.

Elementary Science Study (ESS) Randolph R. Brown, 55 Chapel Street, Newton Massachusetts and McGraw-Hill Book Company, Webster Division.

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